-continued

```
XLAST=X          ;move current values to last
YLAST=Y
ZLAST=Z
XDLAST=XD
YDLAST=YD
```

In another embodiment, the interference evaluation function **106** is not based on position signals. Instead the function asserts the drive enable signal described above to a FALSE state and reads a resulting synchronous capacitance measurement. This measures charge coupled to the electrodes when no voltage is being driven across the electrodes by the apparatus. Such charge must be the result of interference, and so this interference (from spurious signals) is directly measured. This is another way to generate the interference measure, IM.

The preferred frequency select function **108** generates a table of historical interference measurements for each frequency which may be selected. On system initialization, each entry is set to zero. Thereafter, the frequency select function is activated approximately every 32 data points by the interference evaluation function **106**. The current interference measure, IM, is entered as the entry for the currently selected frequency in the table. Then all table entries are scanned. The frequency having the lowest interference measure entry is selected as the new current frequency, and the corresponding M value is sent to the divide-by-(M+N) element **104**. Approximately every 80 seconds, every entry in the table is decremented by an amount corresponding to approximately 0.05 mm of position change. In this way, if a frequency is flagged as "bad" by having strong interference one time, it will not be flagged as "bad" permanently.

The functions described above for the different embodiments could be carried out by a microprocessor such as part no. MC 68HC705P6 manufactured by Motorola, Inc. serving as the microcontroller **102**.

FIG. **8** shows an alternate preferred embodiment of the reference frequency generator **16** (FIG. **1**). It generates a reference frequency signal that varies randomly. Each cycle of the signal has a different and substantially random period. It is extremely unlikely that a spurious signal would coherently follow the same sequence of random variation. Hence the spurious signal is substantially rejected by capacitance measurements synchronous to the reference frequency. The degree of rejection is not as great as in the former embodiment, but the generator is simpler because interference evaluation and frequency selection functions are not needed.

The generator of FIG. **8** includes an oscillator **110** and a divide-by-(N+M) circuit **112**. The value M supplied to the divider comes from a pseudo-random number generator (PRNG) **114** which generates numbers in the range 0 to 15. Each cycle of the reference frequency clocks the PRNG **114** to produce a new number. PRNGs are well known in the art.

For either embodiment in FIGS. **7** or **8**, the range of values for M in relation to the value of N can be increased or decreased to give a greater or lesser range of possible frequencies. The value of N or the oscillator frequency can be adjusted to change the maximum possible frequency. A phase-locked frequency synthesizer such as the Motorola MC145151-2, or a voltage controlled oscillator driven by a D/A converter, could also preferably be employed instead of the divide-by-(M+N) circuit.

It should be understood that other variations of the preferred embodiments described above fall within the scope of this invention. Such variations include different electrode array geometry, such as a grid of strips, a grid of diamonds, parallel strips and various other shapes. Also included are different variations of electrode array fabrication, such as printed circuit board (PCB), flex PCB, silk screen, sheet or foil metal stampings. Variations of the kinds of capacitance utilized are included, such as full balance (see Gerpheide '017), stray, mutual, half balance.

The above description has provided certain preferred embodiments in accordance with this invention. It is apparent by those skilled in the art that various modifications can be made within the spirit and scope of the invention, which are included within the scope of the following claims.

What is claimed is:

1. A capacitance-based proximity sensor for locating the position of an object while rejecting a frequency of electrical interference, comprising:

(a) an electrode array for forming capacitances which vary with movements of the object,

(b) measurement means coupled to the electrode array for measuring the capacitances synchronously with a reference signal, and

(c) generator means for supplying a reference signal to the measurement means, said reference signal having a frequency which is not coherent with the frequency of electrical interference, wherein the generator means comprises means for evaluating the electrical interference and for producing the reference signal, and wherein the evaluating means includes means for storing a table of frequencies of selected reference signals and measures of electrical interference IM for each of these frequencies, and for producing a reference signal whose frequency has the lowest IM associated therewith.

2. A capacitance-based proximity sensor for locating the position of an object while rejecting electrical interference, comprising:

(a) an electrode array for forming capacitances which vary with movements of the object,

(b) measurement means coupled to the electrode array for measuring the capacitances synchronously with a reference signal,

(c) object locator means responsive to the measurement means for producing a position signal, having a high frequency component, indicating the position of the object relative to the electrode array,

(d) generator means for supplying a reference signal to the measurement means, said reference signal having a frequency which is not coherent with the frequency of the electrical interference, and wherein said generator means comprises

evaluation means responsive to the object locator means for determining the magnitude of the high frequency component of the position signal, and

means responsive to the evaluation means for changing the frequency of the reference signal when the magnitude of the high frequency component of the position signal exceeds a predetermined value.

3. A capacitance-based proximity sensor for locating the position of an object while rejecting electrical interference, comprising:

(a) an electrode array for forming capacitances which vary with movements of the object,

(b) measurement means coupled to the electrode array for measuring the capacitances synchronously with a reference signal, wherein said measurement means comprises